(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 392 504 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent: 24.09.1997 Bulletin 1997/39

(51) Int Cl.6: H04N 1/40, G01T 1/16, H04N 1/00, G21K 4/00

(21) Application number: 90106945.0

(22) Date of filing: 11.04.1990

(54) Method for generating radiation image signals

Verfahren zur Erzeugung von Strahlungsbildsignalen

Procédé de génération de signaux d'images à radiation

(84) Designated Contracting States:
DE FR NL

(30) Priority: 11.04.1989 JP 91240/89
09.06.1989 JP 147536/89
09.06.1989 JP 147537/89
24.01.1990 JP 13910/90

(43) Date of publication of application:
17.10.1990 Bulletin 1990/42

(60) Divisional application: 97104427.6

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No transform to freq. domain.

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EP 0 392 504 B1

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a method for generating a radiation image signal wherein an image signal is obtained by reading out a radiation image which has been recorded on a recording medium during an image recording operation using a grid and which comprises an object image and a striped grid image corresponding to the grid and superposed upon the object image. This invention also relates to an image processing method for such a radiation image. This invention further relates to a radiation image read-out apparatus wherein a method for generating a radiation image signal is employed.

Description of the Prior Art

Techniques for reading out a recorded radiation image in order to obtain an image signal, carrying out appropriate image processing on the image signal, and then reproducing a visible image by use of the processed image signal have heretofore been known in various fields. For example, as disclosed in Japanese Patent Publication JP-A-61(1986)-5193, an X-ray image is recorded on a sheet of X-ray film having a small gamma value designed for the type of image processing to be carried out, the X-ray image is read out from the X-ray film and converted into an electric signal, and the electric signal (image signal) is processed and then used for reproducing the X-ray image as a visible image on a copy photograph or the like. In this manner, a visible image having good image quality with high contrast, high sharpness, high graininess, or the like can be reproduced.

Also, when certain kinds of phosphors are exposed to radiation such as X-rays, α-rays, β-rays, γ-rays, cathode rays or ultraviolet rays, they store part of the energy of the radiation. Then, when the phosphor which has been exposed to the radiation is exposed to stimulating rays such as visible light, light is emitted by the phosphor in proportion to the amount of energy stored during exposure to the radiation. A phosphor exhibiting such properties is referred to as a stimulable phosphor. As disclosed in U.S. Patent Nos. US-A-4,258,264, US-A-4,276,473, US-A-4,315,318, US-A-4,387,428, and Japanese Unexamined Patent Publication No. JP-A-56 (1981)-11395, it has been proposed to use stimulable phosphors in radiation image recording and reproducing systems. Specifically, a sheet provided with a layer of the stimulable phosphor (hereinafter referred to as a stimulable phosphor sheet) is first exposed to radiation which has passed through an object such as the human body in order to store a radiation image of the object thereon, and is then scanned with stimulating rays, such as a laser beam, which cause it to emit light in proportion to the amount of energy stored during exposure to the radiation. The light emitted by the stimulable phosphor sheet, upon stimulation thereof, is photoelectrically detected and converted into an electric image signal. The image signal is then used to reproduce the radiation image of the object as a visible image on a recording material such as photographic film, a display device such as a cathode ray tube (CRT), or the like.

Radiation image recording and reproducing systems which use stimulable phosphor sheets are advantageous over conventional radiography using silver halide photographic materials, in that images can be recorded even when the energy intensity of the radiation to which the stimulable phosphor sheet is exposed varies over a wide range. More specifically, since the amount of light emitted upon stimulation after the radiation energy is stored on the stimulable phosphor varies over a wide range and is proportional to the amount of energy stored during exposure to the radiation, it is possible to obtain an image having a desirable density regardless of the energy intensity of the radiation to which the stimulable phosphor sheet was exposed. In order to obtain a desirable image density, an appropriate read-out gain is set when the emitted light is being detected and converted into an electric signal to be used in the reproduction of a visible image on a recording material or a display device.

During the recording of a radiation image of an object on a recording medium, such as X-ray film or a stimulable phosphor sheet, a grid is often located between the object and the recording medium such that radiation scattered by the object does not impinge upon the recording medium. The grid is constituted of bars of a radiation-impermeable material, such as lead, and bars of a radiation-permeable material, such as aluminium or wood, which are alternately located in parallel at small pitches of approximately 4.0 bars/mm. When the grid is used during the recording of a radiation image of an object on a recording medium, radiation scattered by the object is prevented from impinging upon the recording medium, and therefore the contrast of the radiation image of the object can be kept high. However, a grid image having a striped pattern is recorded together with the object image on the recording medium.

In general, in radiation image read-out apparatuses, wherein an image signal is detected from a recording medium which has a radiation image recorded thereon, light which is emitted from the recording medium and which carries information about the radiation image is photoelectrically detected and converted into an image signal. The image signal is then sampled at sampling intervals of $\Delta x=1/(2 \cdot fss)$ corresponding to the spatial frequency, which is the maximum of a spatial frequency range necessary for image information. The spatial frequency, which is the maximum of a spatial frequency range necessary for image information, is herein denoted by fss. The sampled image signal is then digitized. In cases where the radiation image comprises the object

image and a grid image superposed upon the object image, the image signal obtained in the manner described above includes not only the information representing the radiation image of the object but also noise which is caused to occur by the grid image. The noise will occur even if the spatial frequency of the grid image is higher than the maximum spatial frequency fss necessary for image information.

Figure 6A is a graph showing the spatial frequency characteristics of a radiation image, which has been recorded on a recording medium and which comprises an object image and a grid image superposed upon the object image, along a direction intersecting perpendicularly to the striped pattern of the grid image.

By way of example, it is herein assumed that, during the recording of the radiation image, a grid having the bars of a radiation-impermeable material and the bars of a radiation-permeable material, which are alternately located in parallel at pitches of 4.0 bars/mm, was used. The spatial frequency of the grid image is 4 cycles/mm. Also, it is assumed herein that the spatial frequency fss, which is the maximum of a spatial frequency range necessary for the reproduction of a visible radiation image of the object, is 2.5 cycles/mm.

Figure 6B is an explanatory graph showing how noise occurs when an image signal is sampled at sampling intervals of $\Delta x=1/(2\cdot fss)=0.2$ (mm) corresponding to the spatial frequency fss=2.5 (cycles/mm), i.e. is sampled five times per mm. When such sampling intervals are applied, it is possible to obtain information in the spatial frequency region which is below the spatial frequency fss=2.5 (cycles/mm), which is the maximum of a spatial frequency range necessary for the reproduction of a visible radiation image of the object.

In Figure 6B, the same curve as that shown in Figure 6A is indicated by the solid line. As indicated by the broken line, noise occurs at the position corresponding to 1 cycle/mm, with which the position of the peak occurring at 4 cycles/mm coincides when the curve indicated by the solid line is folded back from the part corresponding to fss=2.5 (cycles/mm). Such noise is referred to as aliasing. Specifically, the aliasing corresponding to a spatial frequency of 4 cycles/mm of the grid image occurs at the position corresponding to 1 cycle/mm.

Figure 6C is a graph showing the spatial frequency characteristics of the radiation image represented by an image signal obtained from the sampling in which sampling intervals of $\Delta x=1/(2\cdot fss)=0.2$ (mm) are applied.

In cases where a visible image is reproduced to a scale of one to one from the image signal, which includes the noise corresponding to the grid image and occurring at the position of 1 cycle/mm, a striped pattern having a spatial frequency of 1 cycle/mm occurs on the reproduced visible image. Even if the spatial frequency of the grid image falls within such a spatial frequency range that the grid image is not very perceptible, when an image signal is sampled, noise which constitutes a striped pattern will occur in such a spatial frequency range that the grid image is perceptible. When the sampled image signal is used in the reproduction of a visible image, a visible image having bad image quality is obtained.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a method for generating a radiation image signal, which includes little noise due to a grid, from a radiation image which has been recorded on a recording medium during an image recording operation using the grid.

The object of the present invention is achieved by the features of the characterizing part of claim 1.

The first method for generating a radiation image signal in accordance with the present invention is based on the findings that the aliasing occurs at a position corresponding to a specific spatial frequency (for example, 1 cycle/mm in Figure 6B) because of the sampling intervals of Δx being constant and adversely affects the image quality of a reproduced visible image.

With the first method for generating a radiation image signal in accordance with the present invention, an image signal is sampled such that a plurality of image signal components are obtained which correspond to a plurality of discrete points on the radiation image, intervals between the discrete points varying irregularly from predetermined intervals at least along a direction intersecting the striped pattern of the grid image on the radiation image. Therefore, aliasing does not occur at a position corresponding to a specific spatial frequency, and an image signal can be generated which includes little striped pattern due to the grid and which represents a radiation image having good image quality.

By way of example, random numbers may be used in order to vary the intervals between the discrete points irregularly. However, the variation in the intervals between the discrete points need not necessarily be completely irregular. For example, a certain pattern of the irregular variation in the intervals between the discrete points may be repeated with a substantially long period.

It depends on the sampling intervals applied during the detection of the original image signal whether the original image signal includes the image signal components representing the grid image or includes the image signal components representing the aliasing caused to occur by the grid image. Therefore, in cases where the original image signal includes the image signal components representing the grid image, the term "reducing or eliminating the spatial frequency components corresponding to a striped pattern or to aliasing" as used herein means reducing or eliminating the spatial frequency components corresponding to the striped pattern of the grid image. In cases where the original image signal includes the image signal components representing the aliasing, the term "reducing or eliminating the spatial frequency components corresponding to a

striped pattern or to aliasing" as used herein means reducing or eliminating the spatial frequency components corresponding to the aliasing.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view showing an example of a radiation image recording apparatus,

Figure 2 is a schematic view showing a radiation image which has been stored on a stimulable phosphor sheet during an image recording operation using a grid and which comprises an object image and a striped grid image corresponding to the grid and superposed upon the object image,

Figure 3 is a perspective view showing an example of a radiation image read-out apparatus wherein an embodiment of the first method for generating a radiation image signal in accordance with the present invention is employed,

Figure 4A is an explanatory graph showing a series of pulses generated at constant time intervals,

Figure 4B is an explanatory graph showing random clock pulses generated by the random clock generator of the radiation image read-out apparatus shown in Figure 3,

Figures 5A and 5B are explanatory graphs showing another embodiment of the first method for generating a radiation image signal in accordance with the present invention,

Figure 6A is a graph showing the spatial frequency characteristics of a radiation image, which has been recorded on a recording medium and which comprises an object image and a grid image superposed upon the object image, along a direction intersecting perpendicularly to the striped pattern of the grid image,

Figure 6B is a graph showing the curve of Figure 6A and aliasing which occurs in an image signal sampled at sampling intervals of $\Delta x=1/(2x2.5)=0.2$ (mm) corresponding to a spatial frequency fss=2.5 (cycles/mm), which is the maximum of a desired spatial frequency range,

Figure 6C is a graph showing the spatial frequency characteristics of a radiation image represented by an image signal sampled at sampling intervals of 0.2mm, which are the same as in Figure 6B.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will hereinbelow be described in further detail with reference to the accompanying drawings.

Figure 1 schematically shows an example of a radiation image recording apparatus. In the radiation image read out apparatus, a stimulable phosphor sheet is used as a recording medium.

With reference to Figure 1, radiation 2 is produced by a radiation source 1 and passes through an object 3. Thereafter, the radiation 2 passes through a grid 4 and impinges upon a stimulable phosphor sheet 11. The grid 4 is constituted of lead bars 4a, 4a, ... and aluminium bars 4b, 4b, ... which are alternately located in parallel at pitches of 4 bars/mm. The radiation 2 is blocked by the lead bars 4a, 4a, ... and passes through the aluminium bars 4b, 4b, ... Therefore, an image of the object 3 and a striped grid image having a pattern of stripes at pitches of 4 stripes/mm are stored on the stimulable phosphor sheet 11. Radiation 2a scattered by the object 3 impinges obliquely upon the grid 4. Therefore, scattered radiation 2a is blocked or reflected by the grid 4 and does not impinge upon the stimulable phosphor sheet 11. Accordingly, a sharp radiation image free of adverse effects of the scattered radiation 2a is stored on the stimulable phosphor sheet 11.

Figure 2 schematically shows a radiation image which has been stored on the stimulable phosphor sheet 11 during the image recording operation using the grid 4. The radiation image comprises an object image 5 (indicated by the oblique lines) and a striped grid image 6 (indicated by vertical stripes) which corresponds to the grid 4 and which is superposed upon the object image 5.

Figure 3 is a perspective view showing an example of a radiation image read-out apparatus wherein an embodiment of the first method for generating a radiation image signal in accordance with the present invention is employed.

With reference to Figure 3, the stimulable phosphor sheet 11, on which the radiation image has been stored, is placed at a predetermined position in the radiation image read-out apparatus. The stimulable phosphor sheet 11 is conveyed at a predetermined speed in a sub-scanning direction indicated by the arrow Y by a sheet conveyance means 15, which is constituted of an endless belt or the like and which is operated by an operating means (not shown). The stimulable phosphor sheet 11 has been placed at the predetermined position such that the striped pattern of the grid image 6 shown in Figure 2 extends parallel to the sub-scanning direction indicated by the arrow Y. A laser beam 17 produced by a laser beam source 16 is reflected and deflected by a rotating polygon mirror 18, which is quickly rotated by a motor 24 in the direction indicated by the arrow. Thereafter, the laser beam 17 passes through a converging lens 19 constituted of an fθ lens or the like. The direction of the optical path of the laser beam 17 is then changed by a mirror 20. The laser beam 17 impinges upon the stimulable phosphor sheet 11 and scans it at a predetermined speed Vx (mm/sec.) in a main scanning direction indicated by the arrow X. The main scanning direction is approximately normal to the sub-scanning direction indicated by the arrow Y. When the stimulable phosphor sheet 11 is exposed to the laser beam 17, the exposed portion of the stimulable phosphor sheet 11 emits light 21 in an amount proportional to the amount of energy stored thereon during its exposure to radiation. The

emitted light 21 is guided by a light guide member 22, and photoelectrically detected by a photomultiplier 23. The light guide member 22 is made from a light guiding material such as an acrylic plate, and has a linear light input face 22a positioned so that it extends along the main scanning line on the stimulable phosphor sheet 11, and a ring-shaped light output face 22b positioned so that it is in close contact with a light receiving face of the photomultiplier 23. The emitted light 21, which has entered the light guide member 22 from its light input face 22a, is guided through repeated total reflection inside of the light guide member 22, emanates from the light output face 22b, and is received by the photomultiplier 23. In this manner, the amount of the emitted light 21 carrying the radiation image is converted into an electric signal by the photomultiplier 23.

An analog output signal S generated by the photomultiplier 23 includes signal components falling in the spatial frequency region above the spatial frequency fss=2.5 (cycles/mm), which is the maximum of a desired spatial frequency range necessary for the reproduction of a visible radiation image having good image quality. Particularly, the analog output signal S includes the signal components, which represents the grid image 6 shown in Figure 2 and which fall in the spatial frequency region above the spatial frequency fss. The signal components representing the grid image 6 adversely affect the image quality of a reproduced visible image and must be reduced or eliminated.

The analog output signal S is logarithmically amplified by a logarithmic amplifier 26. In an A/D converter 27, the amplified analog output signal S is sampled with the timing with which random clock pulses CR are generated by a random clock generator 28. The signal obtained from the sampling is digitized by the A/D converter 27 into a digital image signal SD. The digital image signal SD is stored in a storage means 29.

Figure 4A is an explanatory graph showing a series of pulses generated at constant time intervals of Ts. Figure 4B is an explanatory graph showing the random clock pulses CR generated by the random clock generator 28 of the radiation image read-out apparatus shown in Figure 3. In Figures 4A and 4B, the horizontal axis t represents the time base (sec.).

With reference to Figure 4A, the time intervals of Ts correspond to the sampling intervals of $\Delta x = 1/(2 \cdot fss) = 0.2$ (mm). When the sampling intervals of 0.2mm are applied, an image signal is obtained which represents the image information below the spatial frequency fss=2.5 (cycles/mm), which is the maximum of a desired spatial frequency range necessary for the reproduction of a visible object image having good image quality from the stimulable phosphor sheet 11 shown in Figure 3. The time intervals Ts are represented by the formula

$$Ts = \frac{\Delta x}{Vx}$$

where Vx denotes the speed (mm/sec.) with which the laser beam 17 scans the stimulable phosphor sheet 11 in the main scanning direction.

With reference to Figure 4B, the random clock pulses CR are generated with timing which varies at random with respect to the constant time intervals of Ts.

As described above, the random clock pulses CR are fed into the A/D converter 27 shown in Figure 3. In the A/D converter 27, the amplified analog output signal is sampled with the timing, with which the random clock pulses CR are generated by the random clock generator 28, and converted into the digital image signal SD.

The image signal SD is made up of image signal components sampled with the timing modulated at random. Therefore, aliasing due to the grid image 6 shown in Figure 2 does not occur at a specific spatial frequency, and the image signal SD represents an image having good image quality.

In the embodiment described above, the stimulable phosphor sheet 11 is placed at the predetermined position in the radiation image read-out apparatus of Figure 3 such that the striped pattern of the grid image 6 extends parallel to the sub-scanning direction indicated by the arrow Y in Figure 3. In cases where the stimulable phosphor sheet 11 is placed at the predetermined position in the radiation image read-out apparatus of Figure 3 such that the striped pattern of the grid image 6 extends parallel to the main scanning direction indicated by the arrow X, it is necessary that the sampling intervals along the sub-scanning direction be modulated at random. By way of example, the random modulation of the sampling intervals along the sub-scanning direction may be achieved by moving the mirror 20 at random or changing the speed, with which the stimulable phosphor sheet 11 is conveyed in the sub-scanning direction indicated by the arrow Y, at random, so that the intervals between main scanning lines vary randomly in the sub-scanning direction. In cases where the stimulable phosphor sheet 11 is placed at the predetermined position in the radiation image read-out apparatus of Figure 3 such that the direction along which the striped pattem of the grid image 6 extends is not parallel to the main scanning direction nor to the sub-scanning direction or is unknown, it is necessary that both the sampling intervals along the main scanning direction and the sampling intervals along the sub-scanning direction be modulated at random.

The image signal SD generated in the manner described above is stored in the storage means 29 and is then fed therefrom into an image processing and reproducing apparatus 50. The image processing and reproducing apparatus 50 carries out the appropriate image processing on the image signal SD and reproduces a visible image from the processed image signal SD. Because the image signal SD fed into the image processing and reproducing apparatus 50 includes little or no adverse effects of the grid 4, a visible image having good image quality can be reproduced from the image signal

SD.

Another embodiment of the first method for generating a radiation image signal in accordance with the present invention will be described hereinbelow with reference to Figures 5A and 5B.

Figure 5A shows a series of pulses generated at constant time intervals of ΔTs which are markedly shorter than the sampling intervals of Ts necessary for the reproduction of a visible object image. The pulses shown in Figure 5A are generated by a clock generator, which is employed in lieu of the random clock generator 28 shown in Figure 3, and fed into the A/D converter 27. The A/D converter 27 samples a plurality of image signal components at time intervals of ΔTs from the amplified analog output signal S. Thereafter, as shown in Figure 5B, an image signal is extracted with random timing from the image signal components.

As described above, constant sampling intervals (ΔTs) may be applied during the sampling from the amplified analog output signal S, and an image signal may be ultimately obtained which comprises image signal components corresponding to random sampling intervals. The image signal may be simply extracted from a plurality of image signal components obtained from the sampling at time intervals of ΔTs. Alternatively, as indicated by the chained lines in Figure 5B, the mean values of the values of several neighboring image signal components may be calculated, and components having the mean values may be set as new image signal components corresponding to random sampling intervals. As for the sub-scanning direction, the small sampling intervals of ΔTs can be set by, for example, decreasing the speed with which the stimulable phosphor sheet 11 shown in Figure 3 is conveyed.

In the aforesaid embodiments, stimulable phosphor sheets are used. However, the first method for generating a radiation image signal in accordance with the present invention is widely applicable when radiation images are read out, which have been recorded on recording media during image recording operations using grids and each of which comprises an object image and a striped grid image corresponding to the grid and superposed upon the object image. For example, the first method for generating a radiation image signal in accordance with the present invention is applicable also when X-ray image signals are detected from X-ray films having X-ray images recorded thereon.

Claims

1. A method for generating a radiation image signal, which comprises the steps of:
detecting an image signal (S) by reading out a radiation image which has been recorded on a recording medium (11) during an image recording operation using a grid and which comprises an object image and a striped grid (4) image corresponding to the grid and superposed upon the object image
characterized by
sampling said image signal (S) with a timing modulated at random such that the sampled image signal (SD) is made up of a plurality of image signal components which correspond to a plurality of discrete points on said radiation image, the sampling intervals between said discrete points being not constant, varying in accordance with the modulated sampling time at least along a direction crossing the striped patterns of said grid image on said radiation image.

2. A method for generating a radiation image signal as defined in claim 1, wherein said recording medium (11) is a stimulable phosphor sheet on which a radiation image has been stored.

3. A method for generating a radiation image signal as defined in claim 2, wherein said image signal (S) is detected from a read-out operation wherein said stimulable phosphor sheet (11) is exposed to stimulating rays which cause said stimulable phosphor sheet to emit light in proportion to the amount of energy stored thereon during exposure to radiation, and the emitted light is detected photoelectrically.

4. A method for generating a radiation image signal as defined in claim 3, wherein said stimulating rays are a laser beam.

5. A method for generating a radiation image signal as defined in claim 1, wherein said recording medium is photographic film.

Patentansprüche

1. Verfahren zum Erzeugen eines Strahlungsbildsignals, das die Schritte aufweist:

   Erfassen eines Bildsignals (S) durch Auslesen eines Strahlungsbilds, das auf einem Aufzeichnungsmedium (11) während eines Bildaufzeichnungsvorgangs aufgezeichnet worden ist, unter Verwendung eines Gitters, und das ein Objektbild und ein Bild mit gestreiftern Gitter (4) entsprechend dem Gitter und überlegt auf dem Objektbild aufweist, gekennzeichnet durch

   Abtasten des Bildsignals (S) mit einer Zeitabstimmung, die zufallsmäßig moduliert ist, so daß das abgetastete Bildsignal (SD) aus einer Vielzahl von Bildsignalkomponenten aufgebaut ist, die einer Vielzahl diskreter Punkte auf dem Strahlungsbild entsprechen, wobei die Abtastintervalle zwischen den diskreten Punkten

nicht konstant sind, Variieren gemäß der modulierten Abtastzeit mindestens entlang einer Richtung, die die gestreiften Muster des Gitterbilds auf dem Strahlungsbild überquert.

2. Verfahren zum Erzeugen eines Strahlungsbildsignals, wie es im Anspruch 1 definiert ist, wobei das Aufzeichnungsmedium (11) ein stimulierbares Phosphorblatt ist, auf dem ein Strahlungsbild gespeichert worden ist.

3. Verfahren zum Erzeugen eines Strahlungsbildsignals, wie es im Anspruch 2 definiert ist, wobei das Bildsignal (S) von einem Auslesevorgang erfaßt wird, wobei das stimulierbare Phosphorblatt (11) stimulierenden Strahlen ausgesetzt wird, die bewirken, daß das stimulierbare Phosphorblatt Licht im Verhältnis zu der Menge an Energie, die darauf während einer Aussetzung gegenüber Strahlung gespeichert ist, emittiert, und wobei das emittierte Licht photoelektrisch erfaßt wird.

4. Verfahren zum Erzeugen eines Strahlungsbildsignals, wie es im Anspruch 3 definiert ist, wobei die stimulierende Strahlung ein Laserstrahl ist.

5. Verfahren zum Erzeugen eines Strahlungsbildsignals, wie es im Anspruch 1 definiert ist, wobei das Aufzeichnungsmedium ein photographischer Film ist.

Revendications

1. Procédé de création d'un signal d'image d'un rayonnement qui comprend l'étape suivante

la détection d'un signal d'image (S) par lecture d'une image d'un rayonnement qui a été enregistré sur un support d'enregistrement (11) pendant une opération d'enregistrement d'image avec une grille et qui comporte une image d'un objet et une image d'une grille à bandes (4) correspondant à la grille et superposée à l'image de l'objet,

caractérisé par

l'échantillonnage du signal d'image (S) avec une synchronisation modulée de façon aléatoire afin que le signal d'image échantillonné (SD) soit constitué de plusieurs composantes de signal d'image qui correspondent à plusieurs points séparés sur l'image du rayonnement, les intervalles d'échantillonnage entre les points séparés n'étant pas constants et variant avec le temps modulé d'échantillonnage au moins dans une direction qui recoupe le dessin à bandes de l'image de la grille sur l'image du rayonnement.

2. Procédé de création d'un signal d'image d'un rayonnement selon la revendication 1, dans lequel le support d'enregistrement (11) est une feuille luminescente stimulable sur laquelle a été accumulée une image d'un rayonnement.

3. Procédé de création d'un signal d'image d'un rayonnement selon la revendication 2, dans lequel le signal d'image (S) est détecté à partir d'une opération de lecture dans laquelle la feuille luminescente stimulable (11) est exposée à des rayons de stimulation qui provoquent l'émission, par la feuille luminescente stimulable, de lumière en proportion de la quantité d'énergie accumulée dans la feuille lors de l'exposition au rayonnement, et la lumière émise est détectée photoélectriquement.

4. Procédé de création d'un signal d'image d'un rayonnement selon la revendication 3, dans lequel les rayons de stimulation sont formés par un faisceau laser.

5. Procédé de création d'un signal d'image d'un rayonnement selon la revendication 1, dans lequel le support d'enregistrement est un film photographique.

FIG.1

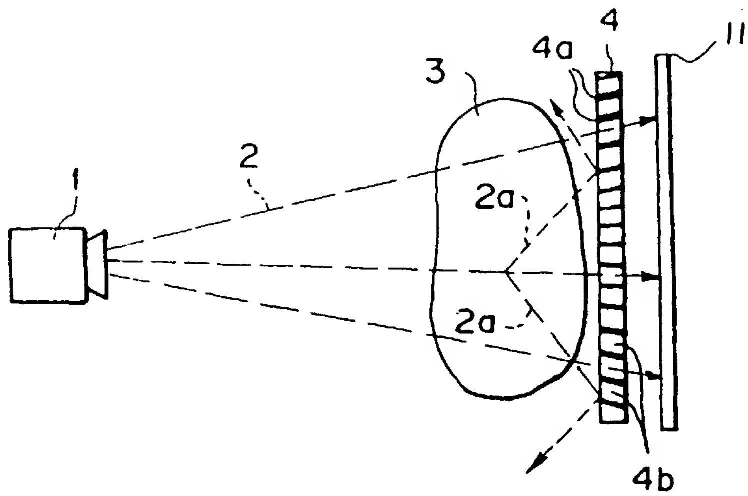

FIG.2

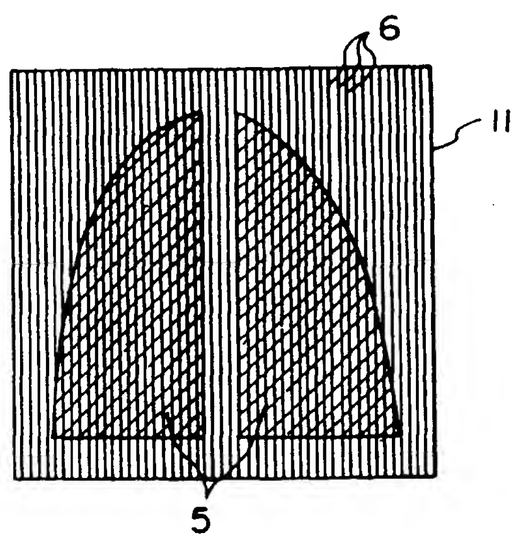

FIG.3

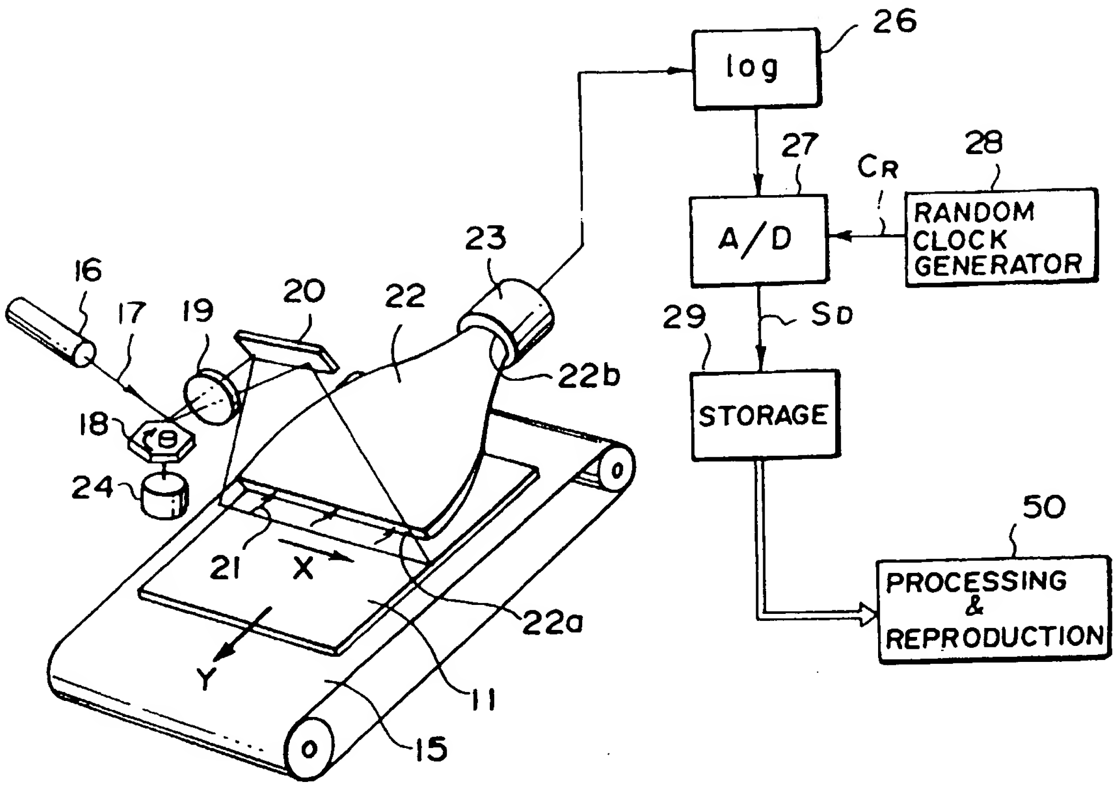
26
log
27
28
CR
A/D
RANDOM
CLOCK
GENERATOR
23
16
20
22
29
SD
17
19
22b
STORAGE
18
θ
24
50
21
X
22a
PROCESSING
&
REPRODUCTION
Y
11
15

FIG.4A

FIG.4B

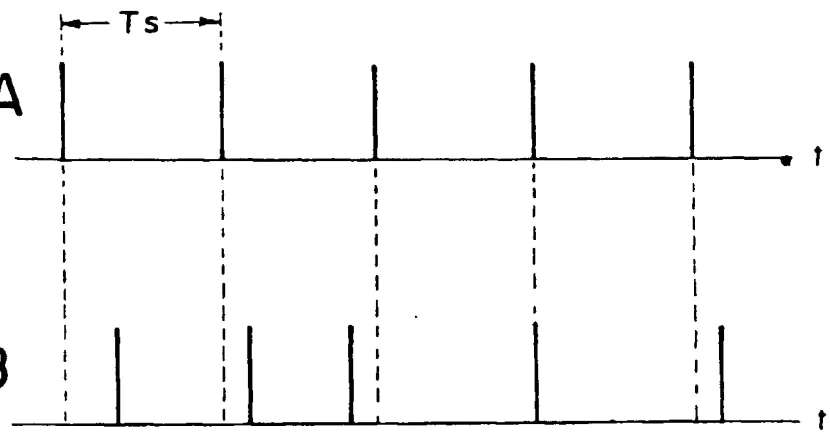

FIG.5A

FIG.5B

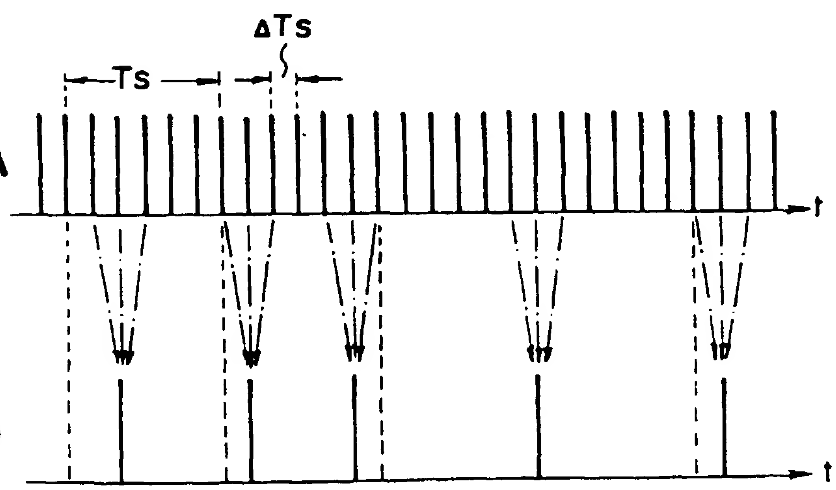

FIG.6A

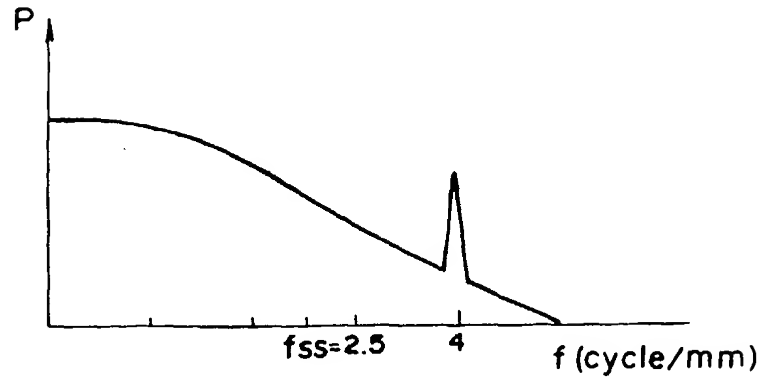

FIG.6B

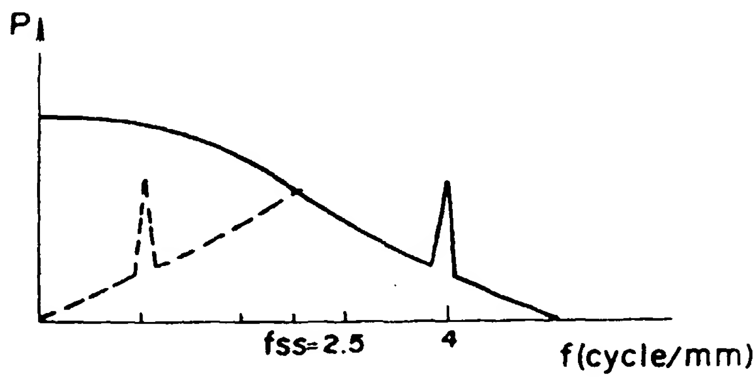

FIG.6C